EUM/C/92/54 Rev.1

EUMETSAT POLAR SYSTEM

Explanatory Note on the Revised Preparatory Programme Proposal

The attached EPS Preparatory Programme Proposal has been redrafted by the Secretariat to reflect the results of the 21st meeting of the EUMETSAT Council, including the establishment of a programme financial envelop of 30 MECU at 1993 economic conditions.

Following the ESA Ministerial Conference in Granada, ESA have revised their long term plan regarding earth observation from polar orbit and propose to develop smaller platforms than originally proposed for the 2.5 tonne payload POEM-l mission. This includes the development of a dedicated operational meteorological mission (METOP) which will better reflect the requirements of operational meteorology. The nominal launch date for the first METOP platform is the year 2000.

NOAA have also recently revised their long term plans regarding their polar orbiting spacecraft. NOAA propose to develop a smaller class of spacecraft for the next generation of spacecraft (NOAA-O,P,Q) than originally planned. Furthermore, NOAA plan to extend their coverage of the "morning" polar orbit to the year 2000, therefore allowing a slip in the launch of the European spacecraft from 1998 (the nominal POEM-l launch date). To ensure continuity of observations from the "morning" orbit until 2000 and the "afternoon" orbit until the introduction of the NOAA-0,P.Q series, NOAA propose to procure two further spacecraft of the same design as the NOAA-K,L,M series - designated NOAA-N and NOAA-N'. NOAA have requested that EUMETSAT provide a microwave humidity sounding instrument for each of these two spacecraft.

The instrument interfaces for the METOP and NOAA-O,P,Q spacecraft have to be jointly negotiated between EUMETSAT and NOAA.

The EUMETSAT Council Resolution concerning the EUMETSAT Polar System (EUM/C/92/Res. VIII) opened for voting at the 21st EUMETSAT Council is attached.

EUMETSAT POLAR SYSTEM

PREPARATORY PROGRAMME PROPOSAL

The Preparatory Programme Proposal for the EUMETSAT Polar System (EPS) reflects the decisions taken at the 21st meeting of the EUMETSAT Council, and takes into account recent developments at ESA and NOAA.

The EPS Preparatory Programme is an essential element to evaluate and negotiate the contents and the costs of the full EPS Programme, resulting in a more cost effective programme development. This will be achieved by developing more consolidated mission and instruments assumptions and more detailed system specifications before entering into development contracts. The EUMETSAT requirements will be negotiated with the partner Agencies to ensure the development of an operational meteorological mission affordable by EUMETSAT.

The EPS mission objectives are detailed in reference document EUM/STG/92/58.

1 INTRODUCTION

1.1 Outline of the EPS Programme

The EUMETSAT Polar System is the proposed contribution to the meteorological polar orbiting observing system. This contribution is aimed at ensuring the timely availability of meteorological data from a series of morning (Europe) and afternoon (USA) polar orbiting spacecraft.

The EPS concerns both the space observing system (jointly provided with ESA and NOAA) and the associated ground system. The Preparatory Programme proposal is based on the assumption of the development of the METOP platform by ESA with a first launch in the year 2000. The METOP (METeorological Operational) mission is envisaged as a series of dedicated platforms for operational meteorological observations from polar orbit. These platforms would accommodate the core meteorological payload. (including an advanced infrared sounder) and a complementary climate payload. However, the payload and ground segment activities undertaken within the Preparatory Programme will be independent of the specific platform design that is finally chosen.

1.2 Principle Programme Assumptions

The EPS will involve extensive cooperation with other partners, including ESA NOAA and (optionally) NASA The assumptions are that:

- the EPS Programme will consist of two METOP platforms;
- ESA will develop and procure the first METOP platform for flight in the

morning orbit,
EUMETSAT will procure the second METOP platform,
NOAA will provide two sets of meteorological instruments for flight on the two METOP platforms,
EUMETSAT will provide the Microwave Humidity Sounder (MHS) and Meteorological Communications Package (MCP) for the two platforms,

- two copies of an advanced infrared sounder will be provided to EUMETSAT by a third party for flight on the two METOP platforms,

ESA or third parties will provide the climate payload for both METOP platforms,

- EUMETSAT will provide three copies of MHS for flight on three NOAA platforms (NOAA-O,P,Q),

EUMETSAT (along with all other parties) shall make adequate provision for flight spare items to meet the above commitments,
EUMETSAT will procure the launcher for both METOP platforms,
EUMETSAT will develop and operate the EPS Ground Segment.
Provisionally, EUMETSAT will provide two flight models of a Microwave Humidity Sounder to NOAA for NOAA-N and NOAA-N'.

- Optionally, EUMETSAT will provide a single copy of a Microwave Humidity Sounder to NASA for EOS-PM.

The assumed ESA development schedule for the prototype platform (METOP-1) is shown in figure 1. This consists of:

a 9 month Phase A study in 1993,
a 9 to 12 month Phase B study in 1994,
start of Phase C/D in mid-1995 (lasting 5½ years for detailed design, manufacture, assembly, integration. testing and launch campaign),
required delivery date for the functionally integrated meteorological payload of January 1999,
launch end of 2000.

1.3 Overall Programme Structure

The overall long term programme for the EUMETSAT Polar System is structured into two constituent elements: a Preparatory Programme and a full Programme. The first element is the subject of this Preparatory Programme proposal, and is intended to cover preparatory activities lasting until the end of 1995 for the instruments (Phase B extension, Phase CO) and Ground Segment (Phases A & B).

The full EPS Programme will be further divided into 2 slices: a Pre-operational Slice and an Operational Slice. The Pre-operational Slice is planned to include the procurement of the payload elements for one European platform, three NOAA platforms (including the possible provision for NOAA-IN') and one NASA platform (optional); the procurement of an EPS Ground Segment: the procurement of a single launcher; and five Fears of operation of the Polar System. The Operational Slice is planned to include the procurement and launch of the second European platform; the procurement of payload elements for this platform

and one NOAA platform; and five further years of operation of the Polar System. The overall EPS Programme plan from 1993 to 2010 is illustrated in Figure 1.

The rough order of magnitude of the financial envelope of the Programme is estimated to be 565 MECU for the Pre-operational Slice and 530 MECU for the Operational Slice (at 1991 economic conditions). These figures are dependent on the specific platform design and final procurement options that are selected, and will be revised following the results of the Preparatory Programme activities.

1.4 **Main Features of the EPS Preparatory Programme**

The main features of the Preparatory Programme are:

- to develop and refine the current level of definition of the EPS payload and EPS Ground Segment and to initiate critical development activities,

  to pursue the elaboration of the necessary agreements and plans to assure the development of a prototype of a spacecraft, by ESA, fulfilling EUMETSAT's Polar Operational Mission Requirements and to establish the modalities for embarking the EUMETSAT payload on such a spacecraft.

It is expected that the EPS Preparatory Programme will last for 3 years from the start of 1993 until the end of 1995, with the EPS Programme proposal being submitted to Council for approval in November 1994. It is anticipated that the full EPS Programme will be implemented by mid-1995 and, therefore, that the Preparatory Programme and the full Programme will overlap by some six months. This overlap is required to ensure the availability of funds to initiate the MCP Phase C/D and to ensure the continuity of the MHS Phase C/D activities.

The MHS Phase C/D activities will need to be started during the Preparatory Programme. To facilitate this within the Preparatory Programme funding, a preliminary CO Phase has been defined as part of the normal Phase C/D development. This CO Phase would last 18-24 months and cover detailed design up to a Preliminary Design Review together with the procurement of any critical long lead items. A smooth transition is envisaged from Phase CO to the remainder of Phase C/D. This development scheme allows for the possible provision of MHS for NOAA-N,N'.

To meet a required launch date in 2000, the MCP Phase C/D work will need to start in mid-1995. This development is considered as part of the full EPS Programme and requires that the full EPS Programme be implemented by mid- 1995.

(The phases A, B, C, D, and E define a series of activities which are concept feasibility (Phase A), system specification (Phase B), detailed design (Phase C), manufacturing, assembly, integration and test (Phase D) and operation of the system (Phase E). The Phase CO is considered as preliminary Phase C).

2 EPS PREPARATORY PROGRAMME

2.1 Preparatory Programme Objectives

The Preparatory Programme objectives are to pursue the investigation and the specification of the various elements of the **EUMETSAT Polar** System in order to define a coherent system, consistent with the requirements of the European meteorological community and to prepare the full programme proposal.

The Preparatory Programme activities will address the necessary preparatory studies required to implement the full EPS Programme and the continuation of the coordination activities undertaken during 1992. The Preparatory Programme will last from the beginning of 1993 to the end of 1995. The main study plans are shown in Figure 2.

2.2 Contents and Activities

2.2.1 Preparatory Programme Activities Overview

The EPS Preparatory Programme activities can be summarised as follows:

negotiation of Inter-Agency agreements with the partner agencies (NOAA, ESA, NASA, others),
feasibility studies (EPS Ground Segment Phase A),
detailed specifications studies (EPS Ground Segment Phase B),
support to ESA's Phase A and Phase B spacecraft activities for the definition and specification of the METOP mission,
negotiation of instrument-to-platform interfaces with NOAA, following the revision of NOAA's plans, and support to the NOAA instrument studies,
extensions to the MCP Phase B studies to accommodate the revised interface requirements,
detailed planning to prepare for activities to be undertaken in the full EPS Programme (in particular, for the MHS, MCP and ground segment C/D phases),
preliminary design activities and start-up of critical development activities for MHS (Phase CO),
preparation of the EPS Programme proposal for submission to the EUMETSAT Council for approval.

It is intended that the results of these activities will be:

draft agreements with partner agencies,
refined mission specifications,
refined system specifications.
refined interface requirements,
Preliminary Design Review data pack for MHS,
an EPS Programme proposal, including costed industrial plans, presented to the EUMETSAT Council for decision.

The Preparatory Programme activities are presented in more detail in the following sections.

2.2.2 Meteorological Payload Activities

2.2.2.1 European Instruments

i) Microwave Humidity Sounder (MHS)

The output of the MHS Phase B studies (completed July 1992) have provided detailed instrument specifications, which are being used for Phase C/D planning activities.

The competitive selection of the contractor for Phase C/D is planned for the end of 1993, with the start of Phase C/D in early 1994. The selection will be made on responses to an ITT for the complete Phase C/D work. A procurement proposal will be presented to the June 1993 Council for approval, allowing an ITT to be issued shortly afterwards.

The activities considered within the framework of the proposed Preparatory Programme consist of a Phase CO which will address the preliminary activities of a normal Phase C. In addition, any essential breadboarding activities and the procurement of any critical long lead items will be included in this Phase CO. This Phase CO has been introduced to allow Phase C/D to be started within the Preparatory Programme, and allows for the possible provision of MHS for NOAA-N,N'. Though a single contract will be placed for the complete Phase C/D work, the contract shall include the right to terminate work at the end of Phase CO.

(The provision of a MHS for the NASA EOS-PM platform in exchange for data from the Atmospheric InfraRed Sounder (AIRS) will be an option in the full EPS Programme. There is no financial impact at this stage related to this option).

ii) Advanced Infrared Sounder

EUMETSAT proposes to support, through technical expertise, the joint Italian / French project to develop the Infrared Atmospheric Sounding Interferometer (IASI) to ensure consistency with the meteorological requirements and with the rest of the meteorological instrument package.

It is understood by the Secretariat that CNES and AS1 will continue the study of IASI through Phase B and that the agency responsible for the C/D phases will provide, at least, a first demonstration flight model.

2.2.2.2 NOAA/NASA Instrument Procurement

The schedules of the initial (and subsequent) design stages of both the NOAA and the EUMETSAT instrument and platform studies are closely interrelated and need to proceed in an iterative way. Therefore, EUMETSAT proposes to coordinate the instrument-to-platform interface activities and, following NOAA's decision to review their plans, to define the instrument interfaces in cooperation with NOAA

2.2.2.3 Meteorological Communications Package (MCP)

The MCP provides the direct broadcast services and the electrical interface between the morning spacecraft and the meteorological instruments. The competitive MCP Phase B studies will be completed in October 1993.

The MCP specification must be well established prior to the start of equipment procurement activities. Also the hardware implementation must be sufficiently advanced so that the MCP equipment is available for subsequent Meteorological Payload testing. Therefore, an extension to the Phase B studies will be required to investigate the optimal accommodation of the revised instrument interfaces (following negotiation with NOAA).

A procurement proposal for the MCP Phase C/D will be presented at the November 1994 Council, together with the full EPS Programme proposal, to allow Phase C/D to start in 1995 to meet a 2000 launch date.

2.2.3 Platform Activities

The primary objectives are to negotiate with ESA the establishment of ESA Programme leading to the development of a prototype of an operational series of satellites, and to jointly draft an Inter-Agency agreement_

In addition EUMETSAT will support ESA technical activities related to the Phase A and Phase B METOP studies, to finalise the definition and specifications of the METOP mission.

2.2.4 Ground Segment Activities

Two competitive Pre-phase A studies have been completed. These EPS Ground Segment studies provided initial conceptual and system definitions for the processing and distribution of the operational data. These studies did not address spacecraft command and control.

Phase A studies, i.e concept and system definition, will be initiated in early 1993. These studies will cover the definition of the spacecraft command and contro' function, and will include the requirements for processing the climate payload

data. A procurement proposal will be presented at the June 1993 Council.

Phase B studies, i.e system specification, are planned to be performed during 1995. A procurement proposal for the Phase B studies will be presented at the June 1994 Council.

Other small studies or consultancies will be initiated as the need arises to solve specific problems and provide independent advice during the definition of the EPS ground segment. Such studies would include:

- studies related to use of the data from the climate payload, calibration and validation logistics,
- user related studies.

2.2.5 Preparation of Agreements

EUMETSAT will continue to pursue the elaboration of the associated agreements and project plans. These are between:

EUMETSAT and NOAA	(relating to provision of space equipment, data exchange and support services),
EUMETSAT and ESA	(relating to the accommodation and operation of the operational met payload on the first morning platform and relating to the development by ESA of a prototype METOP),
EUMETSAT and NASA (EOS)	(relating to provision of MHS for EOS-PM, in exchange for pre-operational data from AIRS, ref. EUM/C/92/32).

2.3 Legal Framework

As explained in section 1, the EPS Preparatory Programme and the full EPS Programme are bound together to ensure the proper continuity of the activities and to meet the schedule milestones of the Programme. However, legally, the EPS Preparatory Programme and the full EPS Programme are independent.

The EPS Preparatory Programme, as a new programme, shall be approved by a unanimous vote of all EUMETSAT Member States (Art. 5 and 17 of the EUMETSAT Convention). The EUMETSAT Contractual Rules and Procedures shall be applied for all activities and Inter-Agency Agreements shall be submitted to the Council for approval. The resolution (EUM/C/92/Res. VIII) presented for adoption at the 21st Council is attached as Annex I. It contains the financial envelope of the programme and the scale of contributions.

The full EPS Programme Proposal is planned to be presented for approval at the end of 1994.

2.4 Preparatory Programme Costs

The following tables show the cost of the main activities of EPS during 1993, 1994 and 1995. The figures are estimates based on the latest information available, and assume that all decisions and approvals are positive and occur as planned.

2.4.1 Preparatory Programme in 1993

	Payment Appropriation	Commitment Appropriation
Phase A Studies		
Ground Segment study 1:	500 KECU	800 KECU
Ground Segment study 2:	500 KECU	800 KECU
Phase B Studies		
Extension to MCP Phase B, study 1:	250 KECU	**400 KECU**
Extension to MCP Phase B, study 2:	250 KECU	**400 KECU**
Additional Studies		
Contingencies:	200 KECU	
Total EPS study budget in 1993	**1700 KECU**	
Consultancy expenditure:	300 KECU	300 KECU
Staff cost and Infrastructure:	1 120 KECU	1 200 KECU
Ground Segment Division:	80 KECU	
	1500 KECU	

TOTAL EPS Preparatory programme budget required **in** 1993..... **3 200 KECU (1993 economic conditions)**

2.4.2 Preparatory Programme in 1994

	Payment Appropriation	Commitment Appropriation
Phase A Studies		
Ground Segment study 1:	300 KECU	
Ground Segment study 2:	300 KECU	
Phase B Studies		
Extension to MCP Phase B, study 1:	150 KECU	
Extension to MCP Phase B, study 2:	150 KECU	
Phase CO Activities		
Phase CO MHS:	**10 000 KECU**	15 000 KECU
Additional Studies		
Contingencies:	350 KECU	
Total EPS **study budget in 1994**	**11 250 KECU**	
Consultancy expenditure:	**300 KECU**	**300 KECU**
Staff cost and infrastructure:	1 **350 KECU**	1 **650** KECU
Ground Segment Division:	**300 KECU**	
	1 **950 KECU**	

TOTAL EPS Preparatory programme budget
required in 1994..... **13 200** KECU (1993 economic conditions)

2.4.3 Preparatory Programme in 1995

	Payment Appropriation	Commitment Appropriation
Phase B Studies		
Ground Segment study 1:	3OOOKEcu	**3 000 KECU**
Ground Segment study 2:	3OOOKEcu	3OOOKEcu
Phase CO Activities		
Phase CO MHS:	**5 000 KECU**	
Additional Studies		
Contingencies:	300 **KECU**	
Total EPS study budget in 1995	**11300 KECU**	
Consultancy expenditure:	300 **KECU**	300 **KECU**
Staff cost and infrastructure:	1600 KECU	**2 000 KECU**
Ground Segment Division:	400 **KECU**	
	2 300 **KECU**	

TOTAL EPS **Preparatory programme budget rewired in 1995..... 13 600 KECU (93 economic conditions1**

3 CONCLUSION AND DECISIONS

This document provides the technical, financial and legal framework for a decision on setting up a EUMETSAT **Polar System Preparatory Programme.**

The activities to be undertaken during the EPS Preparatory Programme, will aim at refining the polar mission and the polar system specifications, and prepare for the full prograrnme proposal which will include programme costs.

The activities will address mainly:

- drafting of various agreements with partner agencies,
- definition and specification of the METOP mission in collaboration with ESA,

  coordination with NOAA on the NOAA instrument activities,
- technical collaboration with ESA in accommodating the meteorological payload on a METOP platform
- feasibility and detailed specification of the EPS Ground Segment,
- detailed specification for the MCP,

  preliminary design phase (Phase CO) for MHS,

  support to the development of the French/Italian IASI,
- supplementary studies as identified in the budget given in the section 2.4.

The EPS Preparatory Programme is planned to last 36 months. The level of expenditure of the Preparatory Programme will be of the order of 3.2 MECU in 1993, 13.2 MECU in 1994 and 13.6 MECU in 1995, with a total financial envelope, through to the end of 1995, of 30 MECU at 1993 economic conditions.

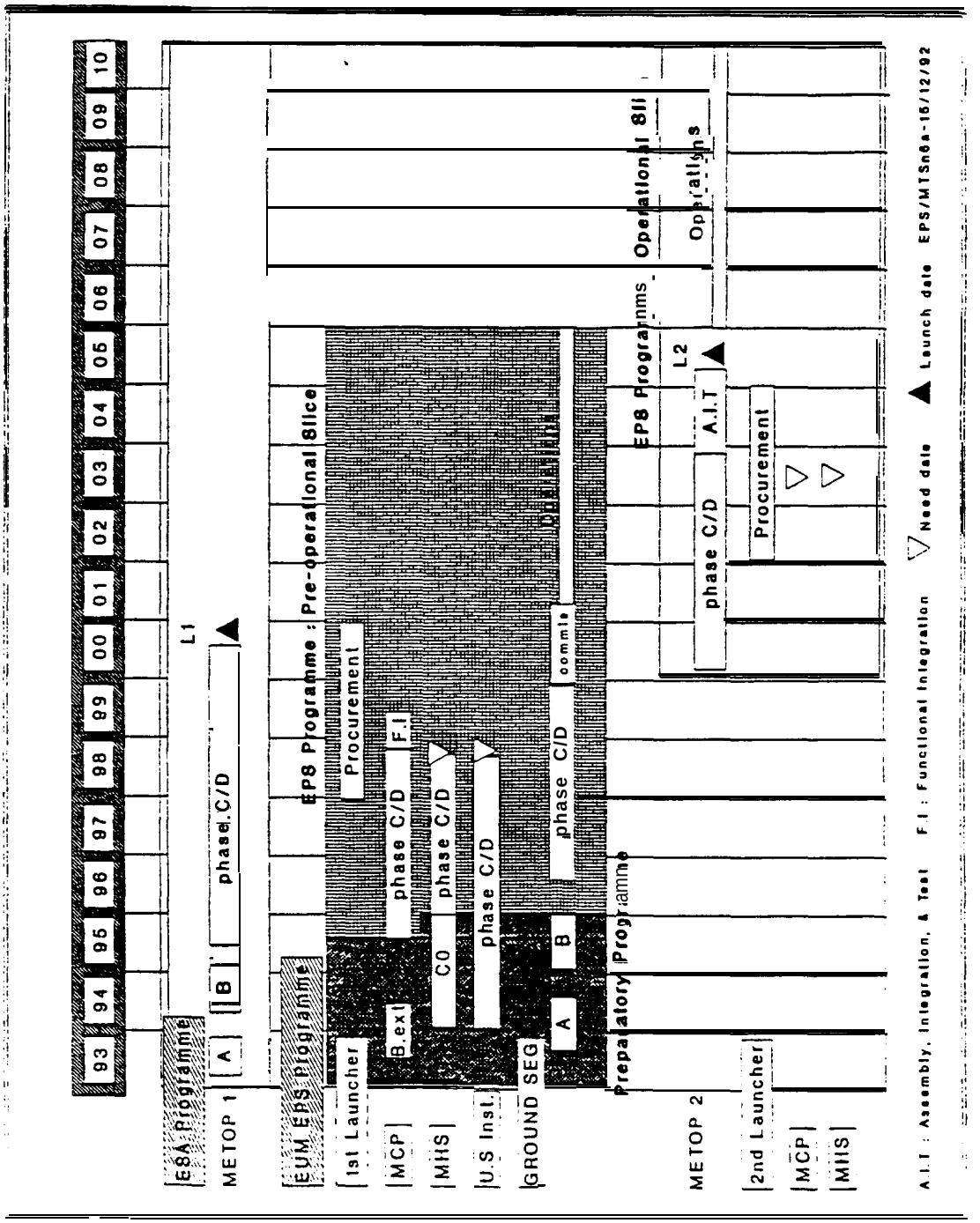
The intent is to request approval for:

the above mentioned Preparatory Programme activities,

setting a dedicated financial structure for funding these activities.

Council is invited to approve the **EPS Preparatory Programme Proposal.**

Figure 1 : EPS PREPARATORY PROGRAMME AND FULL EPS PROGRAMME



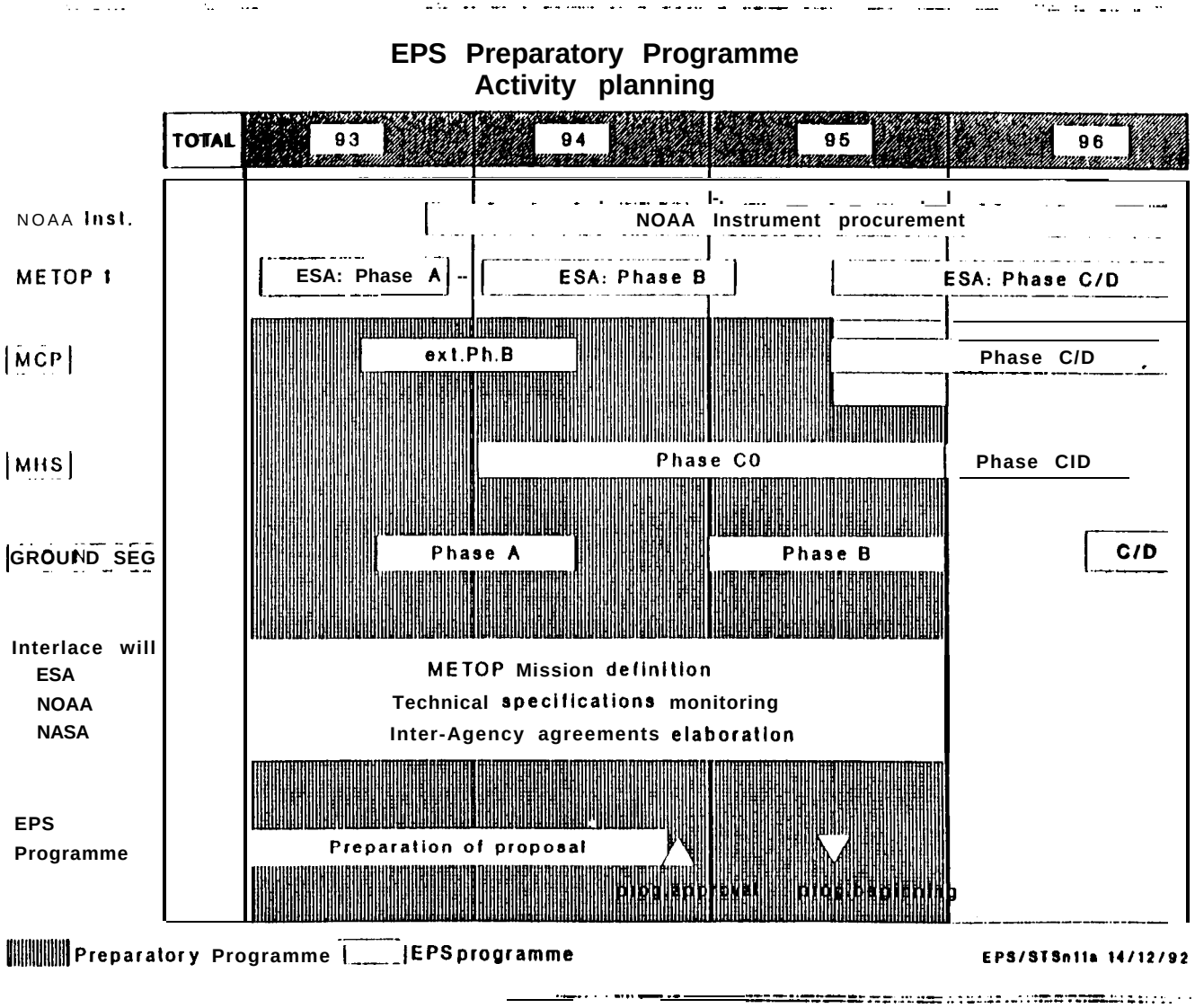


Figure 2 : EPS PREPARATORY PROGRAMME ACTIVITIES

EUM/C/92/Res. VIII

EUMETSAT RESOLUTION ON

THE EUMETSAT POLAR SYSTEM PREPARATORY PROGRAMME

presented for adoption at the
21st EUMETSAT Council on 23-25 November 1992

The EUMETSAT Member States

HAVING REGARD to the EUMETSAT Convention which states that the primary objective of EUMETSAT is to establish, maintain and exploit European systems of operational meteorological satellites,

RECALLING the EUMETSAT Council Resolutions to establish a European polar system,

WELCOMING the Resolution by the ESA Council at Ministerial Level held in Granada concerning the METOP mission,

BEARING IN MIND that polar satellites in both morning and afternoon orbits are essential for operational meteorology and that the morning orbit is of particular importance for Europe for geographical reasons,

CONSIDERING that USA freely provided meteorological data from the polar orbit to the rest of the world for more than 30 years,

NOTING with appreciation that the USA will provide operational meteorological observations from the morning polar orbit until the year 2000,

STRESSING the need to conclude negotiations with ESA on the provision of a prototype satellite of an operational series, for early missions compatible with EUMETSAT operational requirements,

RECOGNISING the benefit of performing the EPS Preparatory Programme for optimisation of the technical specifications leading to a more cost effective and affordable full EPS Programrne,

IN CONFORMITY WITH Article 17.3 of the EUMETSAT Convention,

AGREE:

I **To** establish a Preparatory Programme for a EUMETSAT Polar System commencing in the first quarter of 1993 and lasting until the start of the full EPS Programme, expected to be not later than 1996,

II That the Preparatory Programme shah include:

detailed definition of the mission compliant with EUMETSAT requirements and cost constraints,

development and refinement of detailed specifications of payload elements for the Space Segment,

conduct of feasibility studies and detailed specification studies for the Ground Segment,

the necessary programme management and technical resources for the Space and Ground Segments,

the establishment of cooperation agreements with ESA and NOAA, to be agreed by Council, regarding the joint execution of the complementary programmes,

- activities enabling the possible provision of a Microwave Humidity Sounder to NOAA for NOAA-N.

III That the financial envelope of the Preparatory Programme shall amount to 30 MECU at 93 economic conditions, with an indicative payment profile of 3.2 MECU in 1993, 13.2 MECU in 1994 and 13.6 MECU in 1995.

IV To consider no later than December 1994 the implementation of a full EPS Programme to ensure continuity of industrial activities to meet project schedules and maintain maximum economy.

V To fund the Preparatory Programme on a scale of contributions based on the Gross National Product of the Member States.

VI To amend the Annexes to the EUMETSAT Convention as follows:

Annex I of the Convention will be completed by a new chapter "F".

F - Preparatory Programme for a EUMETSAT Polar System

The EPS Preparatory Prograrnme covers initial Space Segment Payload and Ground Segment activities related to the development of a series of satellites to provide continuous meteorological observations from morning Polar Orbit.

The activities are broken down into three separate areas:

i) **Mission**

Detailed definition of the mission and payload, including climate monitoring objectives, in cooperation with ESA and NOAA leading to the establishment of cooperation agreements with both organisations.

ii) **Space Segment Payload**

Covering the development and refinement of the specification of the Meteorological Communication Package and start of critical development activities for the Microwave Humidity Sounder.

ii) **Ground Segment**

Covering the conduct of feasibility studies and subsequently the establishment of detailed specifications of the Ground Segment.

ANNEX II of the Convention will be completed with a new chapter "F".

"F EUMETSAT POLAR SYSTEM PREPARATORY PROGRAMME **(EPS/PP)**
overall envelope and scale of contributions:

The budge& envelope for the **EPS/PP is** estimated at 30 MECU at 93 economic conditions with a scale of contributions based on Gross National Product:

Germany	22.76%
France	18.03%
Italy	15.33%
United Kingdom	14.63%
Spain	5.99%
Netherlands	4.33%
Switzerland	3.63%
Sweden	3 30%
Belgium	2.87%
Denmark	1.98%
Finland	1.83%
Norway	1.68%
Turkey	1.39%
Greece	0.96%
Portugal	0.74%
Ireland	0.55%
TOTAL	100.00%

The basis for the calculation of the contribution is the Gross National Product statistics issued by the OECD. The current scale of contributions is based on the reference period 1986-1988 applicable for the period 1991-1993. The scale will be updated in tri-annual intervals, starting 1 January 1994.